

The Impact of Changes in Trade Policies on the Electric Vehicle (EV) Sector – a CGE Analysis

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The views expressed in these slides do not reflect the views of the U.S. International Trade Commission or any of its individual Commissioners. Simulation scenario intended to illustrate possible insights.

Overview



BACKGROUND AND
MOTIVATION



MODEL BASELINE
DEVELOPMENT



SIMULATION AND RESULTS

Background and Motivation

- The automotive industry is currently undergoing a transition from internal combustion engine (ICE) vehicles to EVs. Due to its size, changes within the automotive sector can reverberate throughout the entire economy.
- Chinese EV Exports increased dramatically since 2018.
- Existing economy-wide models lack the necessary granularity to capture the upstream and downstream effects of an EV supply chain.

Our Paper's Contributions



CGE model representing the entire vehicle supply chain



Distinguishes between EVs, ICE vehicles, and other vehicles



Distinguishes between upstream (parts) and downstream (finished vehicles)

Our Research

- How do tariffs levied against the Chinese EV supply chain affect global production, trade, and welfare?
- Simulations
 - Global tariff increase by 20 percent on Chinese exports of **electric and hybrid vehicles**
 - Global tariff increase by 20 percent on Chinese exports of **EV parts**

Baseline Development

Baseline Development

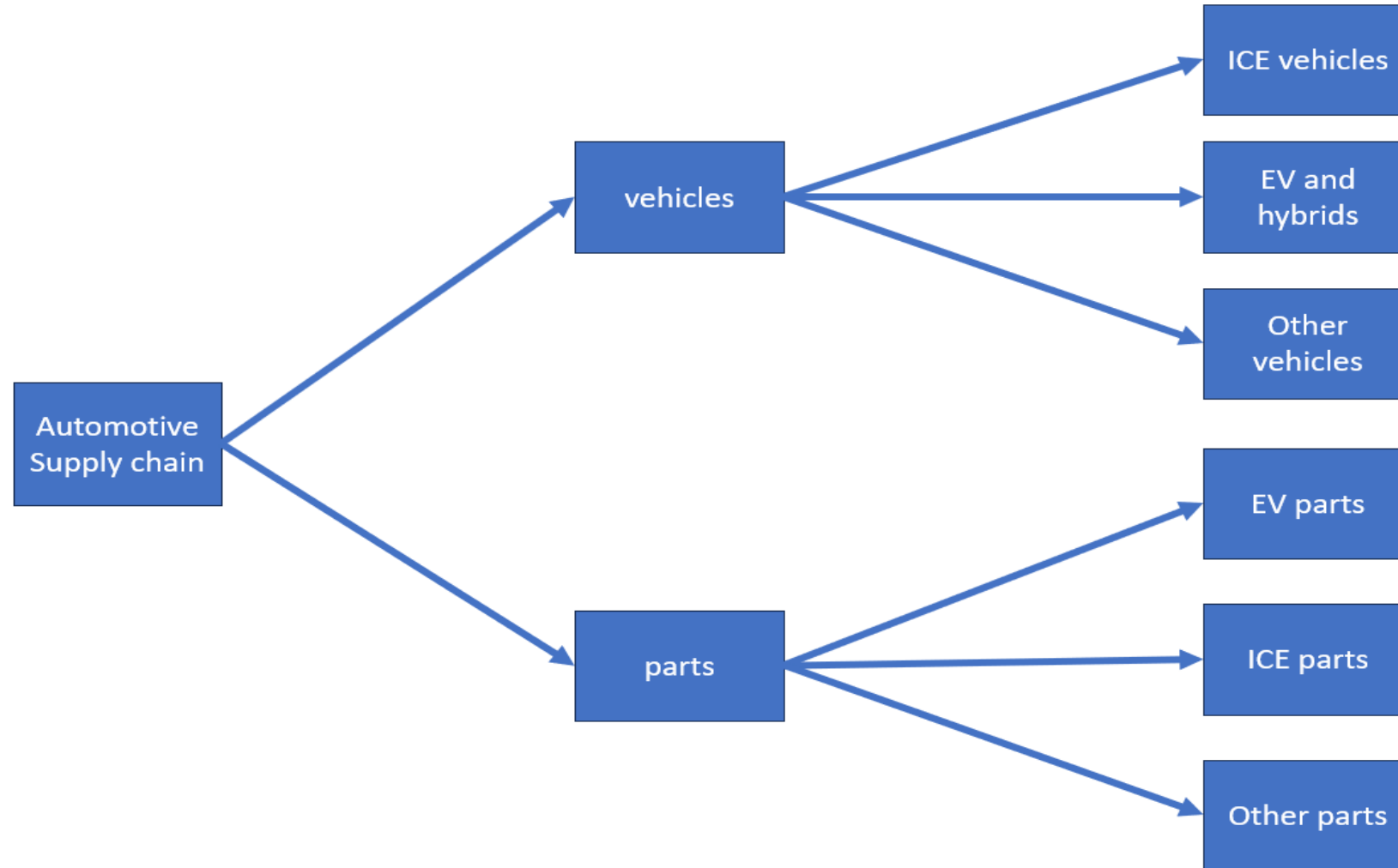
Our model is static and uses the GTAP Version 11 (2017) database

We aggregate the database to six regions: US, EU, Japan, Korea, China and the ROW

The five regions — the United States, the EU, China, Japan and Korea are major producers of EV parts and EVs

We update the GDP components, the total trade flows, and motor vehicles and parts (MVH) sector output **from 2017 to 2022** for the United States, EU, China, Japan, and Korea

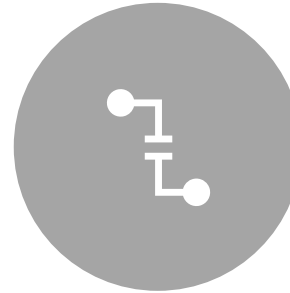
Baseline Development: GTAP sector disaggregation



Baseline Development: GTAP sector disaggregation



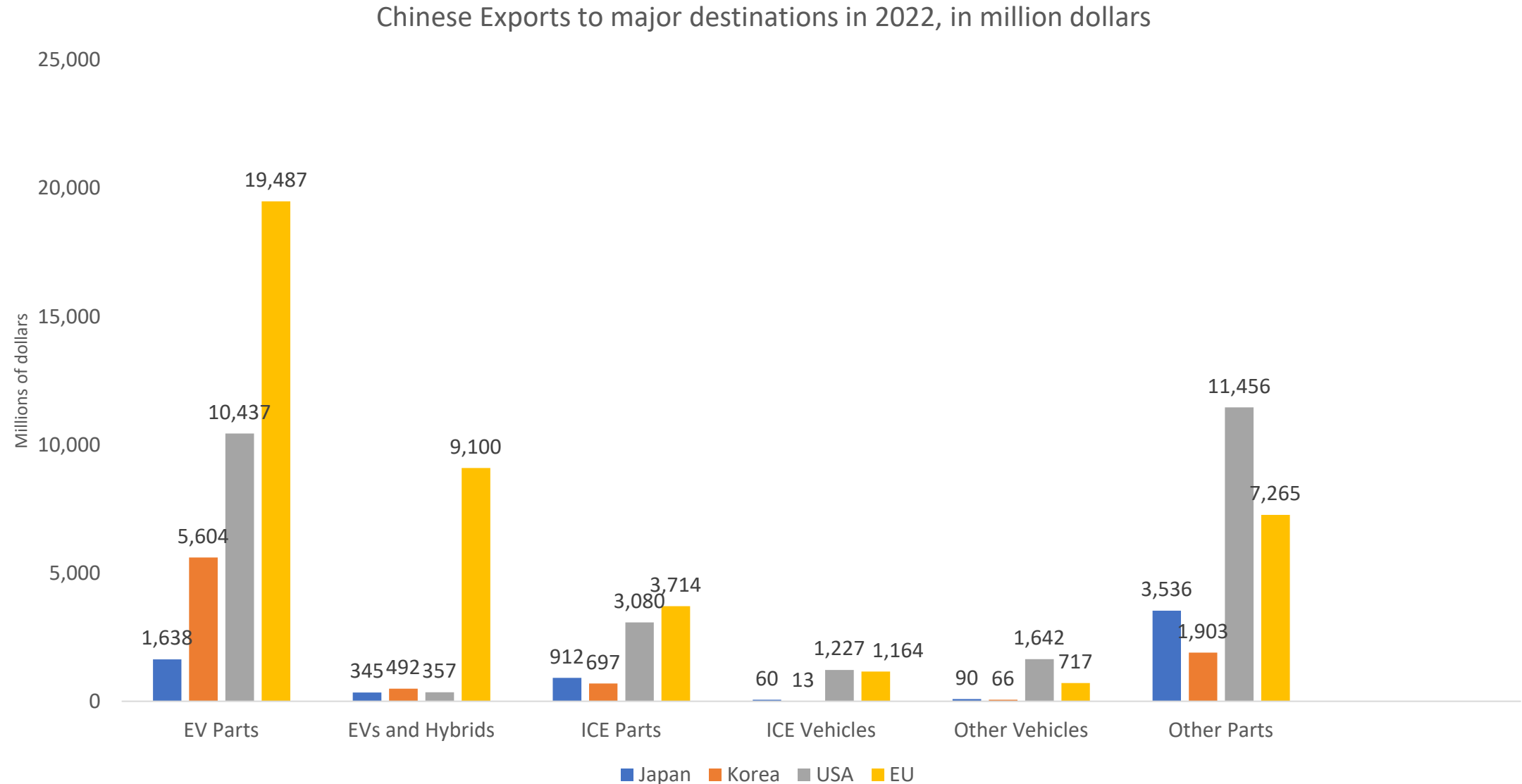
The model has 70 sectors, including the six detailed motor vehicles and parts related sub-sectors.



We performed a full sector split, splitting both the trade data and the production data.

Trade data is split at the HS-6 level.

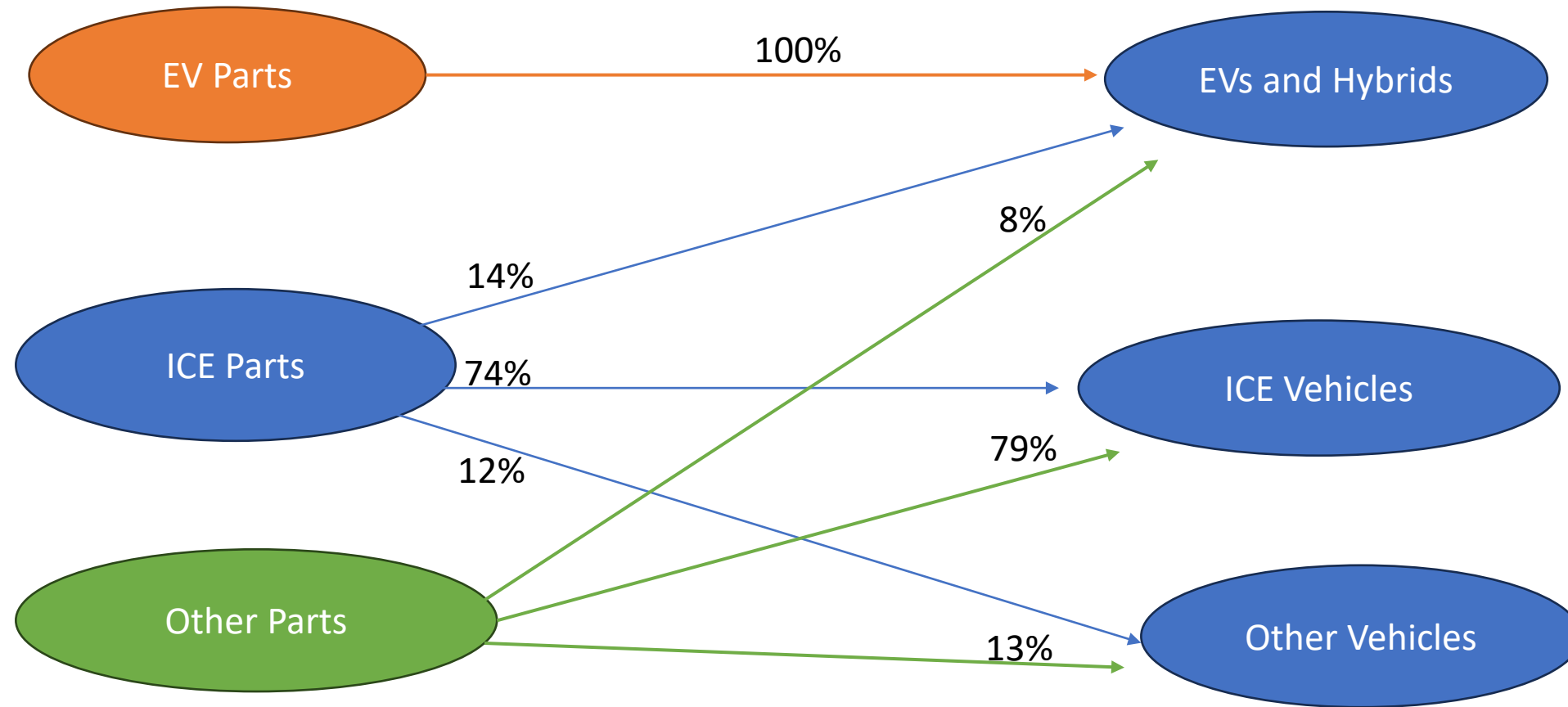
Baseline Development: Chinese exports of EV parts and EVs to major destinations, 2022



Baseline Development: Production data split (2022 production, in million dollars)

	China	Japan	Korea	USA	EU	ROW
EV Parts	79,872	4,160	5,200	6,864	7,280	624
ICE Parts	168,687	60,727	36,549	71,973	120,892	103,461
Other Parts	281,426	56,285	56,285	168,855	337,711	225,141
ICE Vehicles	618,873	174,058	77,359	232,077	309,437	522,173
EV and Hybrid Vehicles	173,828	13,371	16,046	21,394	34,765	8,023
Other Vehicles	16,000	4,500	2,000	6,000	8,000	13,500
Total	1,338,686	313,101	193,439	507,163	818,085	872,922

Baseline Development: production data split (intermediate use, 2022)



Simulation Description and Results

Simulation

We explore two distinct hypothetical scenarios:

- **Simulation 1:** The United States, the EU, Japan, Korea, and ROW all raise their tariffs by 20 percent against Chinese exports of *EVs and hybrids*.
- **Simulation 2:** The same group of regions (United States, EU, Japan, Korea, and ROW) increase their tariffs by 20 percent on Chinese exports of *EV parts*.

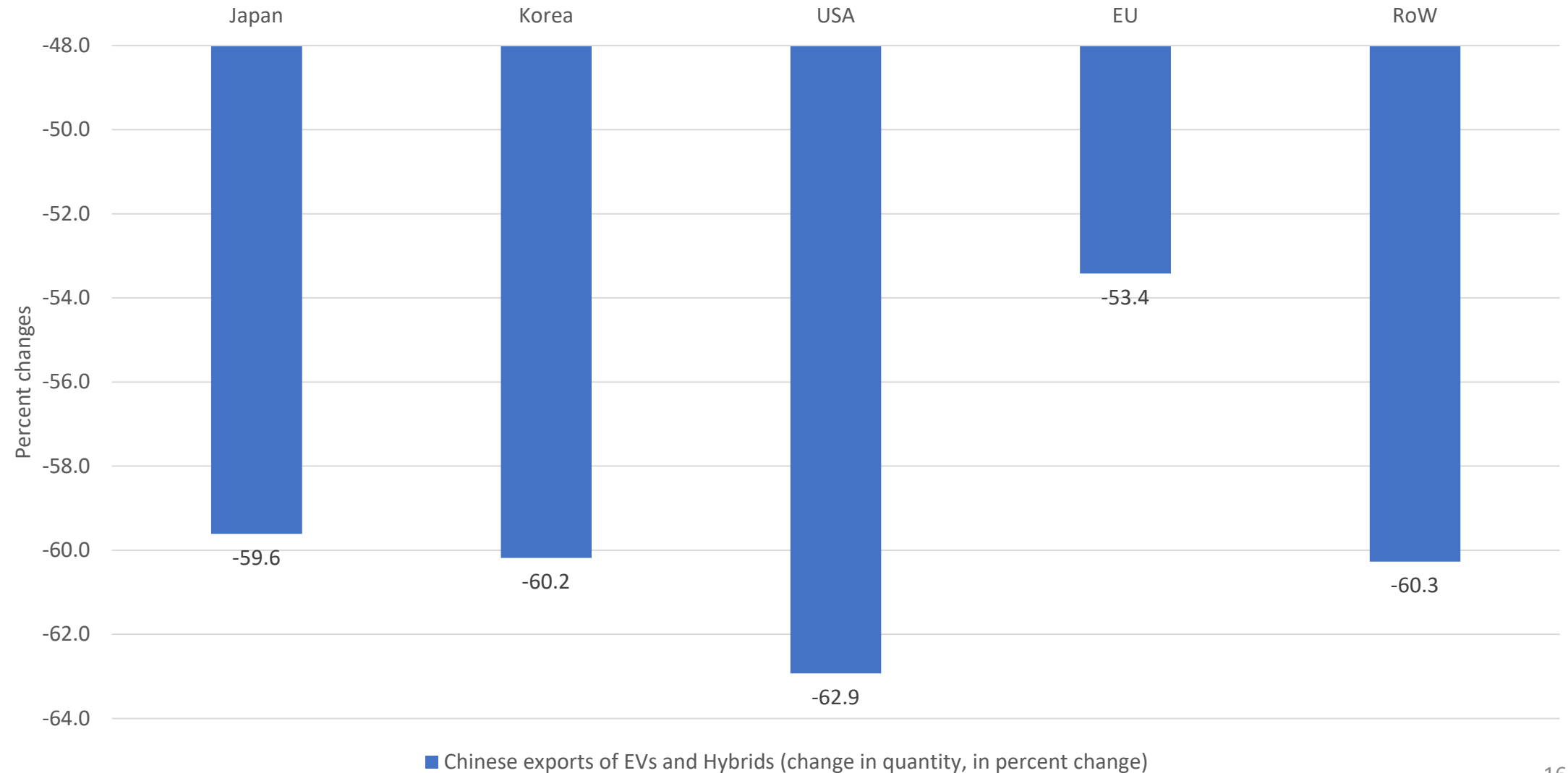
- The simulation scenarios are

- designed to illustrate how simulation outcomes differ when tariffs are applied to *final goods (EVs and hybrids)* versus when they are imposed on *intermediate goods (EV parts)*.
- Other factors like global demand shifts and advancements in battery technology might have far greater impact on the EV industry than tariffs; *simulation results shouldn't be interpreted as expected future changes*.

Key Takeaways from the Results of Simulation 1

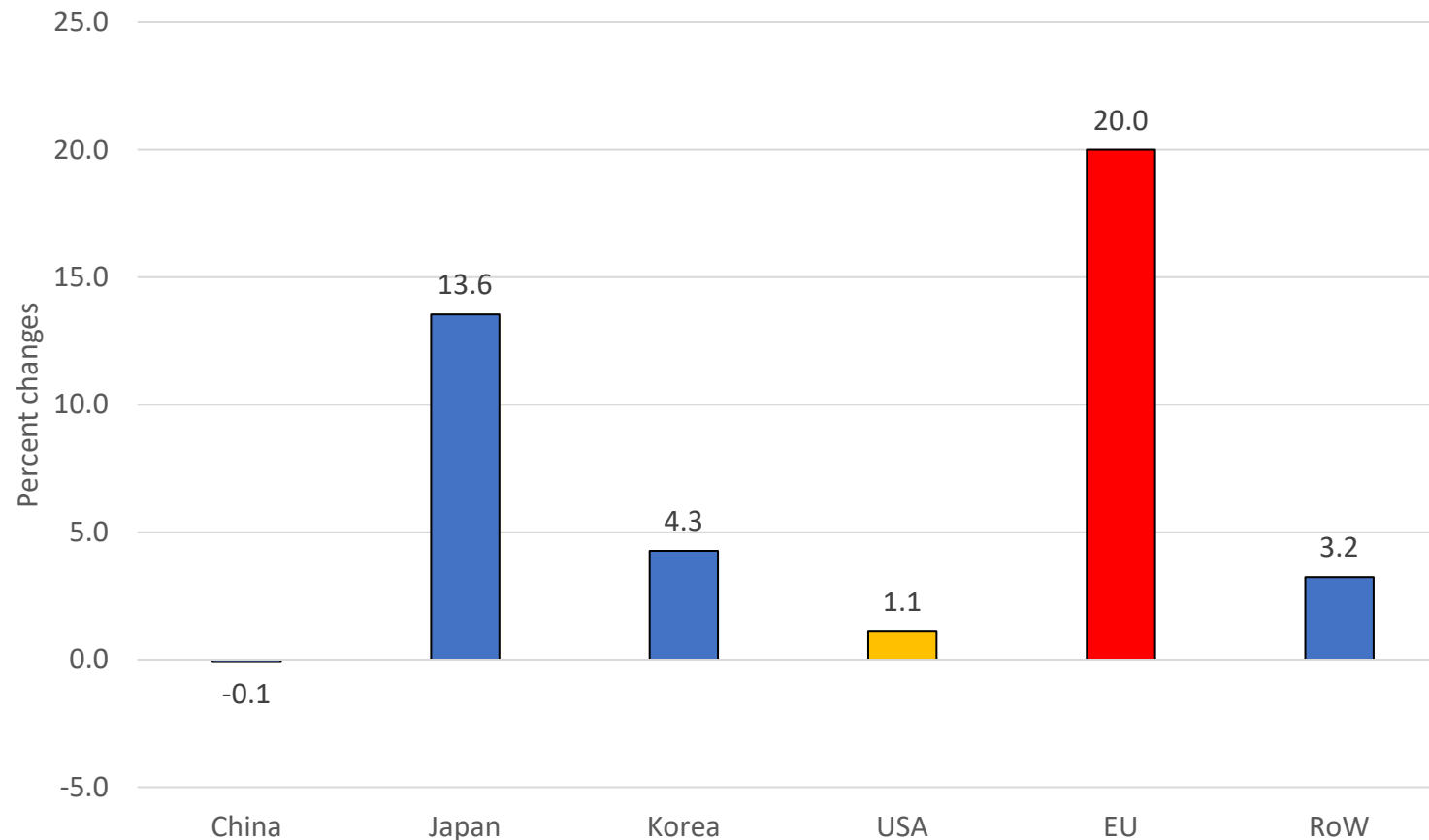
- A global tariff increase on Chinese exports of *downstream EVs and hybrids* raise the cost of Chinese EVs abroad, leading to reduced demand for Chinese EV exports. Consequently, *Chinese EV exports decline worldwide.*
- *Downstream tariffs have mixed impact on upstream parts:* The tariffs unambiguously increase EVs and hybrids production in the U.S., EU, Japan and Korea. These regions experience *increased demand for vehicle parts* due to higher EV production. Chinese parts producers respond by exporting more EV parts overseas. As a result, domestic production of EV parts in these regions still grow, albeit at a moderate rate.

Results from Simulation 1: Chinese exports of EVs and hybrids decline worldwide

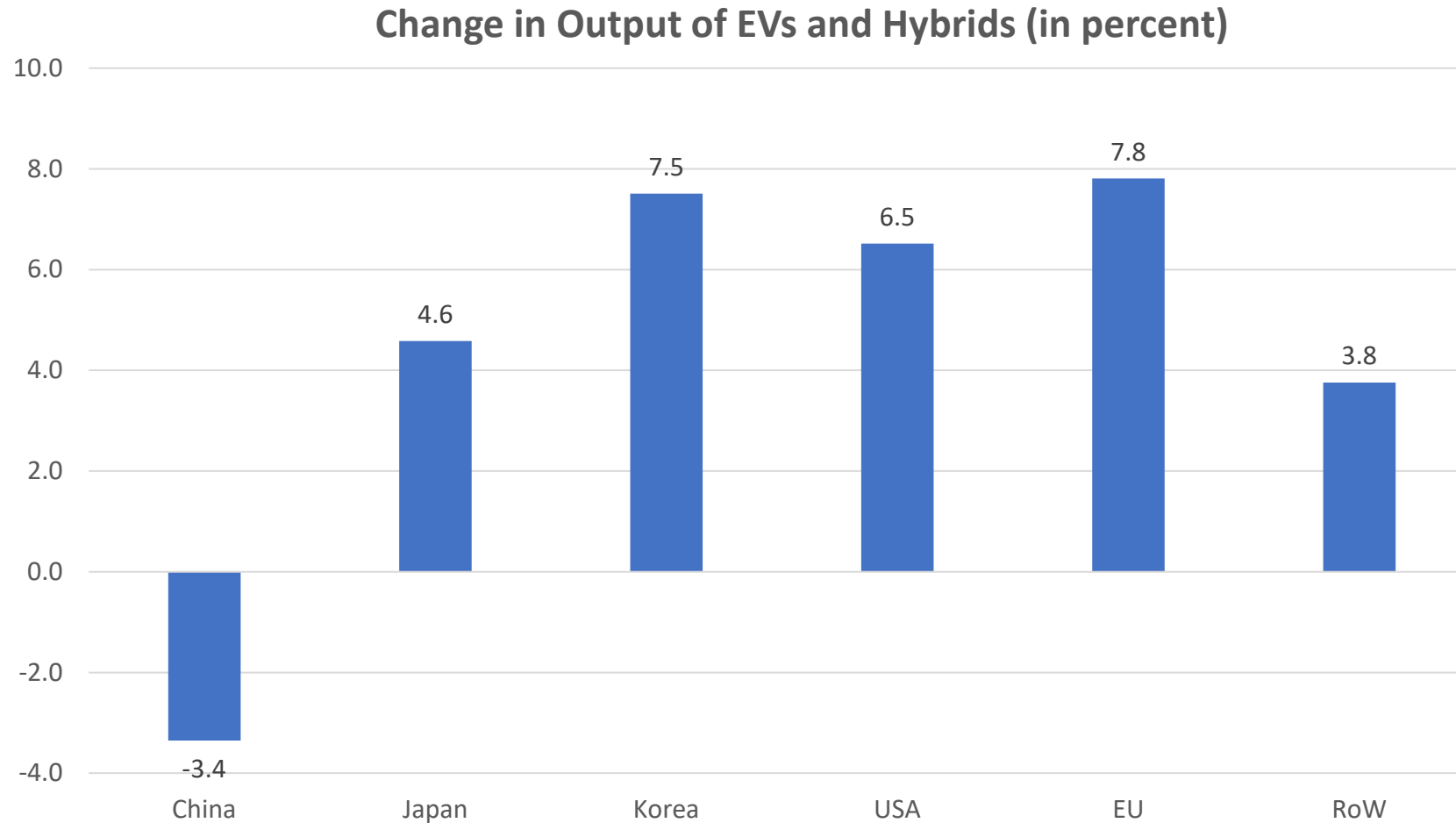


Results from Simulation 1: Total exports of EVs and hybrids from the EU, the United States, Japan and Korea to the world all increases

- Total exports of EVs and hybrids from the EU, the United States, Japan and Korea to the world increase by 7.8 percent, 13.6 percent, 4.6 percent and 10.0 percent, respectively.
- ***Change in EU Exports of EVs and Hybrids (percent deviations from the baseline):***

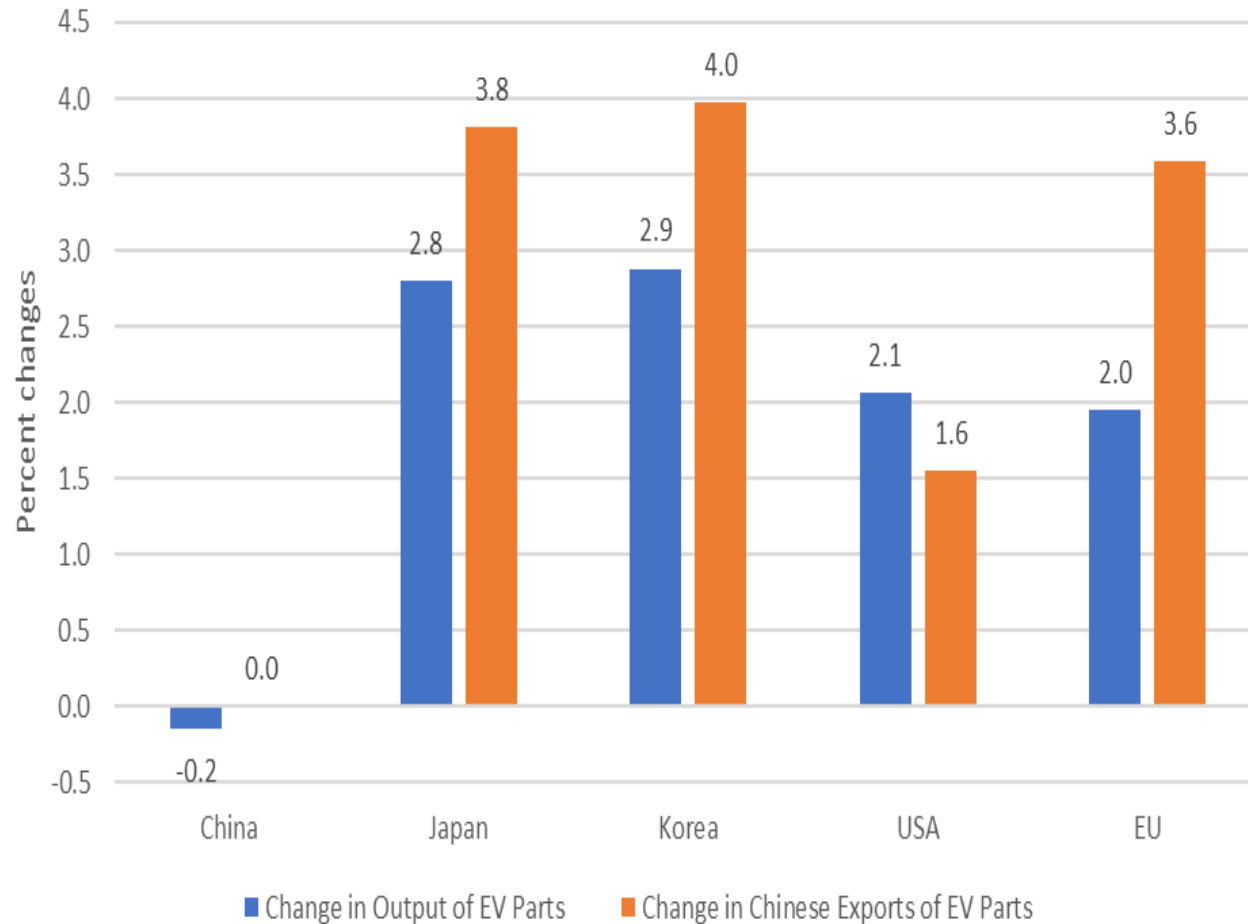


Results from Simulation 1: Increases in EV and hybrid exports from the EU, the U.S., Japan, and Korea boosts their domestic production

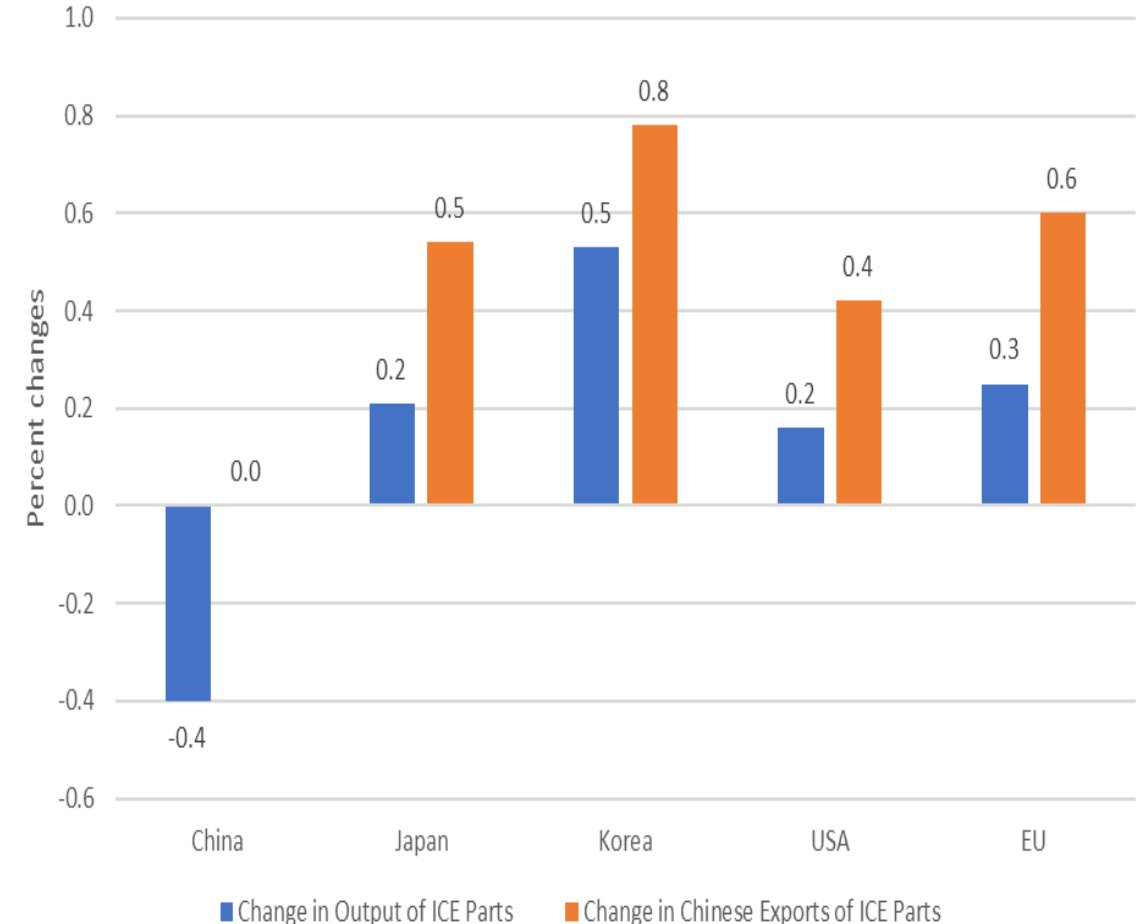


Results from Simulation 1: The expansion of EV and hybrid production in Japan, Korea, EU and the U.S. leads to increased production of EV parts and ICE parts in these countries

Change in Output of EV Parts and Change in Chinese Exports of EV Parts (percent deviations from the baseline)



Change in Output and Change in Chinese Exports of ICE Parts (percent deviations from the baseline)



Results from Simulation 1: Change in Welfare (measured in EV) and Change in Regional Household Income

Region	Change in Consumer Welfare (in million dollars)	Change in Regional Household Income (in percent)
China	-2,558.6	-0.07
Japan	125.4	0.02
Korea	172.8	0.05
USA	709.1	0.02
EU	-614.7	0.003
ROW	624.1	0.01

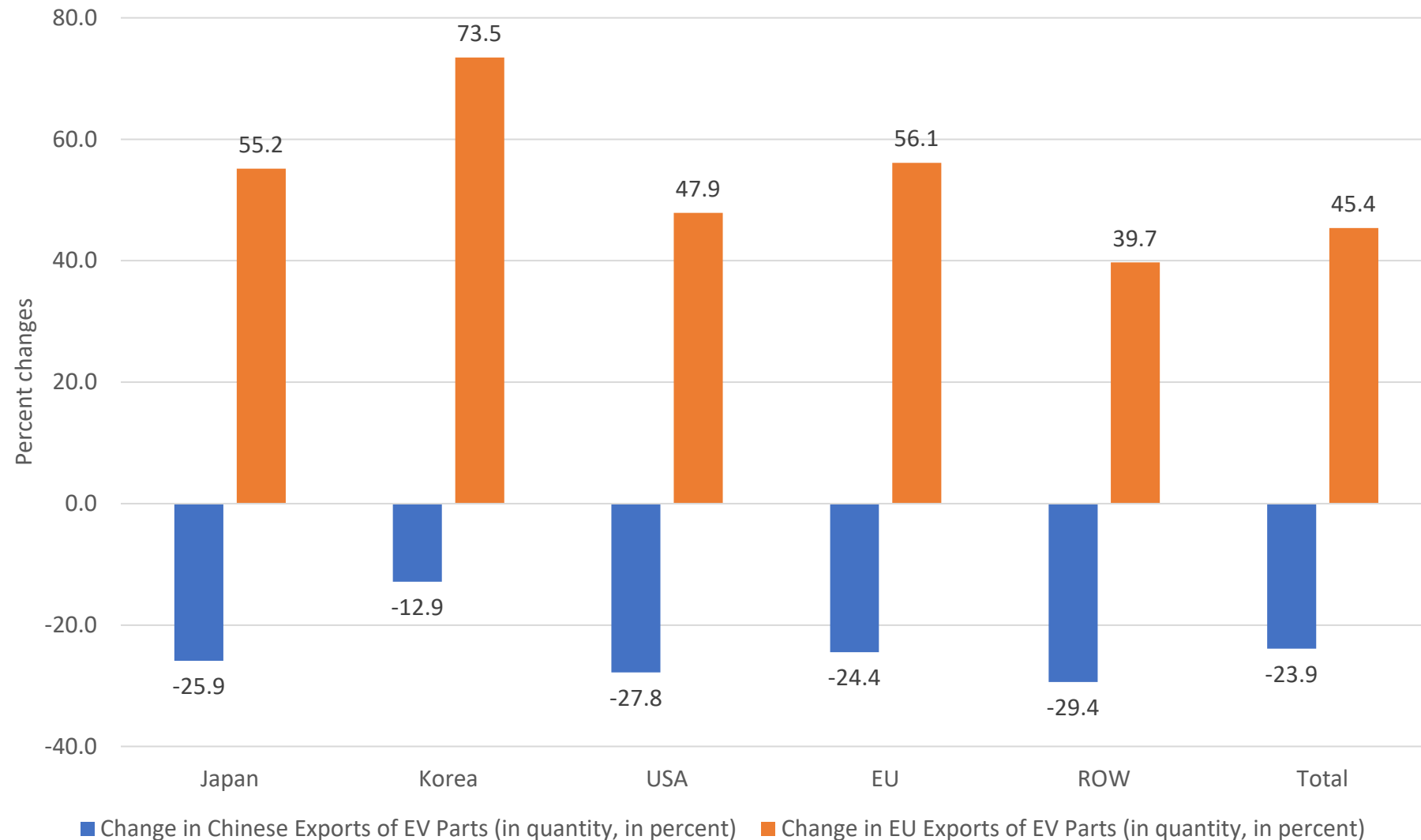
Results from Simulation 2: The U.S., EU, Japan, Korea, and ROW all increase their tariffs by 20 percent on Chinese exports of *upstream EV parts*

Key Takeaways from the Results of Simulation 2

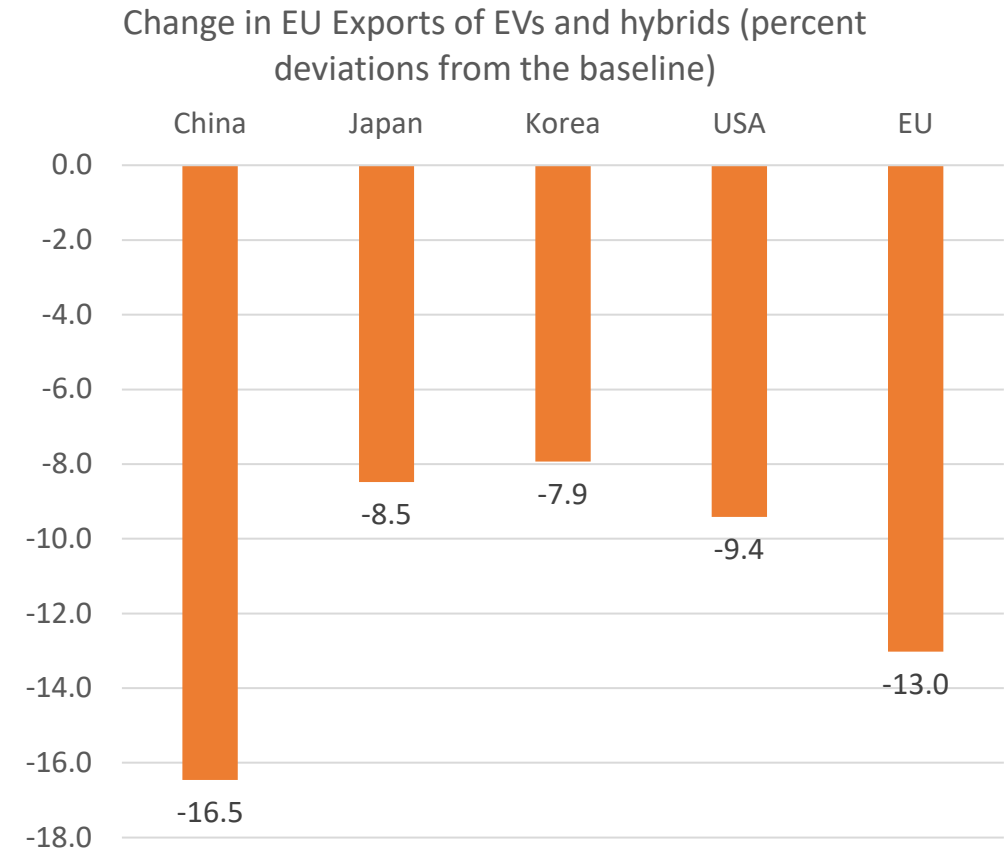
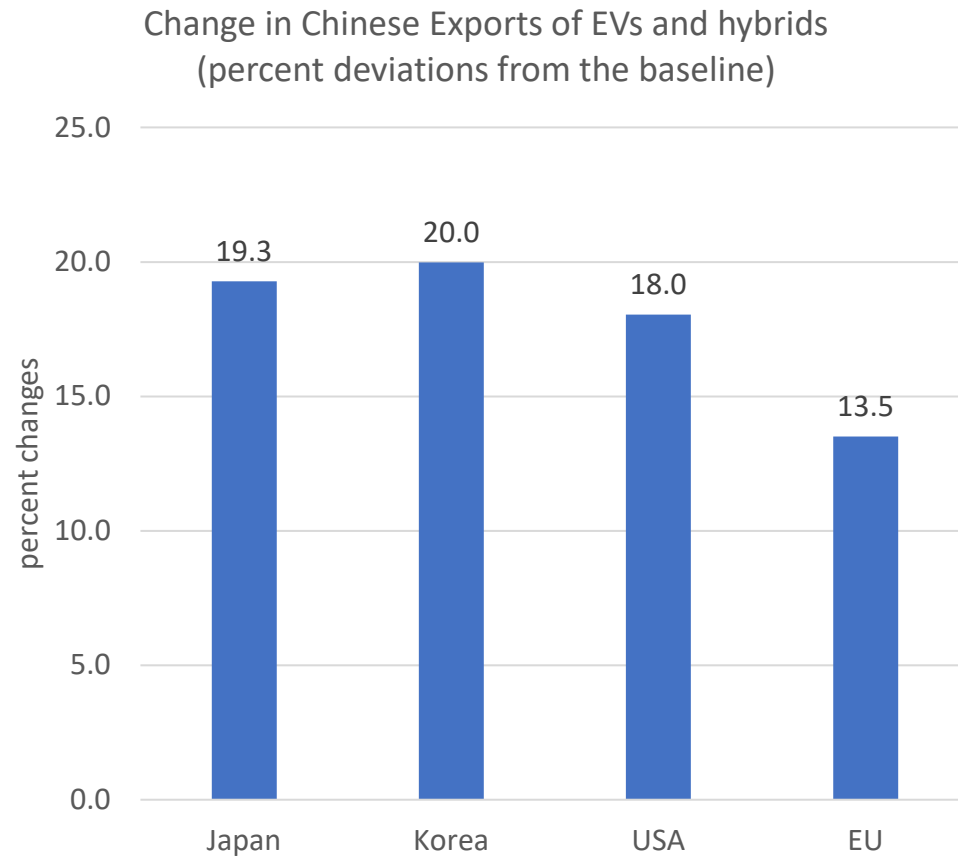
- An increase in global tariffs on Chinese exports of EV parts results in ***a significant decline in Chinese EV parts exports to all regions.***
- Some of these parts, which would have been exported, are either no longer produced or redirected for use in Chinese domestic production of EVs and hybrids.
- As a result, ***relative prices for Chinese EV parts used in downstream EV production decrease.*** Consequently, ***Chinese export prices for EVs and hybrids decrease compared to other major producers.*** This leads to ***an increase in Chinese exports of EVs and hybrids to all other regions*** and a shift in the global trade and production pattern for downstream EVs.

Results from Simulation 2: Chinese EV parts exports to all regions decline significantly; other regions increase their exports of EV parts

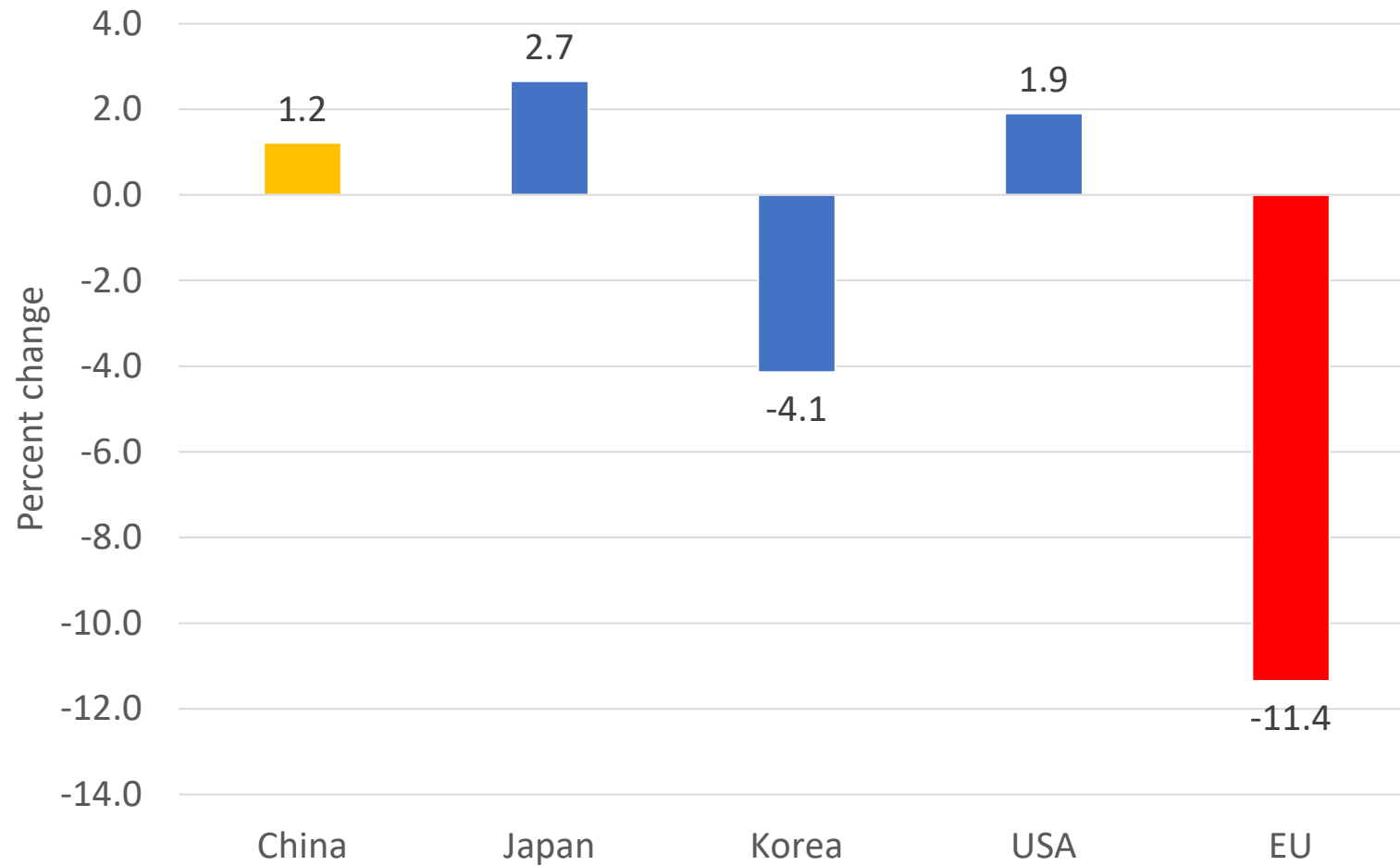
Change in Chinese and EU Exports of EV Parts (percent deviations from the baseline)



Results from Simulation 2: Chinese exports of downstream EVs and hybrids to the world increases; EU exports of EVs and hybrids declines



Results from Simulation 2: Change in Output of Downstream EVs and Hybrids (percent deviations from the baseline)



Results from Simulation 2: Change in Welfare and Regional Household Income

Region	Change in Welfare, in million dollars	Change in Regional Household Income, in percent
China	-3,620.1	-0.09
Japan	462.5	0.06
Korea	-51.7	0.08
USA	278.9	0.03
EU	-384.9	0.01
ROW	807.8	0.02

Conclusion and Future Research

- Our simulation results indicate that the economic effects of imposing a tariff on upstream EV parts differs significantly from imposing a tariff on downstream EVs and hybrids.
- Possible future work:
 - investigate how technological improvements in upstream EV part production affect trade, output, and the overall economy.
 - investigate how changes in non-tariff measures (NTMs) affect Chinese exports of EVs and EV parts, as well as the global trade and production pattern
 - Examine how changes in EV-related production or consumption subsidies affects trade, output and the overall economy

Questions



Appendix Slide: Baseline Development: Update trade statistics and Armington elasticities

- Updated to 2022 trade data
- Updated trade elasticities using Riker and Ahmad 2020 methodology

GTAP Category	NAICS proxy	Elasticity
EV Parts	3362 and 3363 (automotive parts)	4.07
ICE Parts		
Other Parts		
EV and Hybrid Vehicles	3361 (motor vehicles)	5.68
ICE Vehicles		
Other Vehicles		